

*To the Fellows of the
British Balneological and Climatological Society.*

With the Writer's Compliments.

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The Applicability
of Certain Forms of Apparatus in the
Mechanico-Balneological Treatment
(Nauheim Treatment) of Heart Disease

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THE APPLICABILITY OF CERTAIN FORMS OF APPARATUS IN THE MECHANICO-BALNEOLOGICAL TREATMENT (NAUHEIM TREATMENT) OF HEART DISEASE.

A Paper read before the Balneological Society of Berlin.

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(BAD NAUHEIM.)

THE employment of a combination of certain physical methods in the treatment of cardiac insufficiency and of circulatory disturbances, is a comparatively recent development of therapeutic science.

It is not, therefore, surprising that no unanimity of opinion should as yet prevail regarding the precise indications and contra-indications for such treatment ; or that various modifications should be suggested in matters of detail connected with its application.

At present interest centres chiefly upon the question as to whether, and to what extent, mechanical appliances should be used in carrying out the so-called resisted movements, during a course of balneological treatment in heart disease.

The following remarks may serve as a contribution to the settlement of that question. They comprise the results of observations among a large number of cases of heart affections, which I have had the opportunity of making in my practice at Nauheim during the past five years.

Just as the balneological treatment of heart disease is associated with the name of Beneke, so is the addition thereto of gymnastic exercises linked inseparably with that of the late August Schott. Both he and his surviving brother, Dr. Theodore Schott, have, in numerous publications, advocated the employment of manually resisted, as well as of self-resisted exercises.

Doctors A. and T. Schott alike reject the use of appa-

tus, as do their followers, who, by means of numerous detailed treatises and hand-books, have established the treatment in England, France and America.

This rejection Dr. T. Schott bases upon the grounds of inadequate accuracy of dosage in the movements; the impossibility of correctly graduating the degree of resistance for the individual patient, and the considerable first cost of the appliances, in which last connection he refers especially to the Zander apparatus. Theoretical considerations, as well as practical experience, have resulted in convincing me that, of these three main objections, that of cost alone, can claim a certain degree of justification. Herz, however, in his text-book of medical gymnastics, very rightly points out that an important economy is effected for the patient by the use of apparatus to give resistance, instead of the employment of trained specialists for that purpose. This is undoubtedly the case; for a single physician is able to supervise several patients at once while they are using certain mechanical appliances. By means of Zander's, and still more so in the case of Herz's machines, the graduation of dosage and the measurement of resistance in accordance with individual requirements, are capable of the utmost nicety of adjustment, when the working limb is placed in a state of perfect equilibrium. Further, when once the requisite resistance has been determined, it can be accurately maintained, or may, at will, be increased or diminished by as little as a gram at a time.

The gymnast, on the other hand, is obliged to rely solely, to begin with, on his own unaided estimate of his out-put of nervo-muscular energy, while actively or passively assisting in the resisted movements. Afterwards, moreover, when the degree of resistance is raised, he must depend on his own recollection of the amount previously afforded.

The comparison between mechanical and manual gymnastics, with regard to accuracy of dosage and minute graduation of resistance, is undoubtedly, favourable to the mechanical method; but, if that be used, a most important point to be emphasised is that the resistance must be obtained by means of levers and weights, and *not* by elastic traction. The well-known and, of late, much lauded "Exercisers" and "Developers," fitted with elastic cords, are, consequently, entirely unsuited for our

purpose. They are, in fact, dangerous; since they are not susceptible of proper control, and the rapid rise of resistance inseparable from their use is apt to lead to overstrain and injury to the damaged heart.

It might be supposed that the so-called "self-resisted" exercises were the least productive of strain, since they are performed by the patient himself, without any apparatus or the intervention of another person. It must not be forgotten, however, that for the effective execution of a self-resisted movement, it is necessary to contract not only the group of muscles, the combined activity of which produces the desired motion, but, also, simultaneously to maintain a continuous contraction of their antagonists; such tonic contraction representing the internal resistance of the patient himself. The object is to ensure that the group of muscles destined to carry out the specific movement, shall contract with a degree of energy slightly greater than that exhibited by their antagonists. The result is a movement of extreme slowness, in which, as there is no manifestation of resistance, it might seem to be entirely absent.

Now, it is obvious that during this exercise of concentrated will power, a continuous and exceedingly intense strain must be imposed upon the attention of the patient, and that, as a consequence, fatigue of the cortical centres must before long supervene. Concurrently there will be a sensation of exhaustion, both cardiac and general.

This condition is especially undesirable for a cardiac patient. It is noteworthy that the originator of self-resisted movements, Dr. Theodore Schott, has considered it necessary to point out this danger, and he holds that for children they should be seldom used, and then only under the strictest supervision. I go still further, in that I am of opinion that every kind of exercise which is productive of a sense of fatigue, is absolutely contra-indicated in cardiac therapeutics. It is not the extreme limit of capacity which should be aimed at, since fatigue and overstrain must, at that point, be dangerously near; but just that degree of stimulation which is calculated, through suitable movements, to regularise the circulation and to relieve the heart. This is attained by the determination of blood to the working extremities, in obedience to the physiological law that increased circulation occurs in actively contracting muscles.

In consequence of this law, which I consider to be the key to all gymnastic treatment in heart affections, the application of resisted movements must be confined practically to the extremities ; while movements of the lower limbs are of greater comparative utility than those of the upper, on account of the greater distance of the former from the heart, and their greater blood-containing poten-

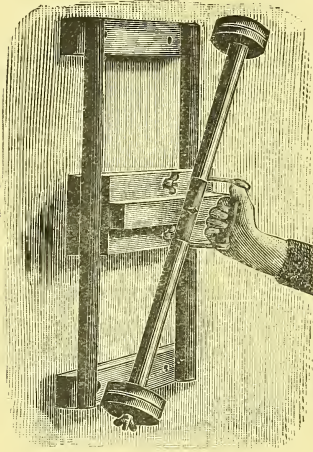


FIG. 1.—Arm rolling.

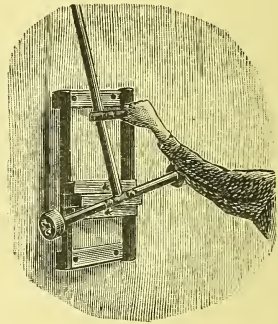


FIG. 2.—Arm circling.

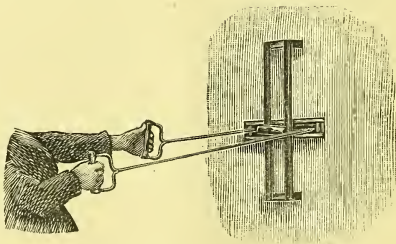


FIG. 3.—Self-resistance Apparatus.

tiality. The performance of any precise, set task, such as would be assigned in the orthopædic treatment of muscular or articular affections, is here to be avoided, and advantage should rather be taken of the peculiar phenomenon that, by the introduction of a minimal degree of resistance, a subjective sensation of lightened labour is imparted. Thilo has already called attention to this seeming paradox,

in his System of Gymnastics, while Herz has very properly still further emphasised this point in his latest work, which I regard as marking an important advance in cardiac gymnastics. For example, it involves a greater strain slowly to rotate the unsupported arm in the air, than to effect the same movement with an apparatus, even when no impetus has been imparted to the latter. Again, it is easier for the outstretched arm to pull a light weight by means of a cord and pulley, than to go through similar exercises as free movements with no weight superadded.

While, however, Thilo and Herz consider that the result of imparting a slight resistance is simply a diminution of internal effort, there is also, in my opinion, a similar reduction of the external and of the total work performed, if,

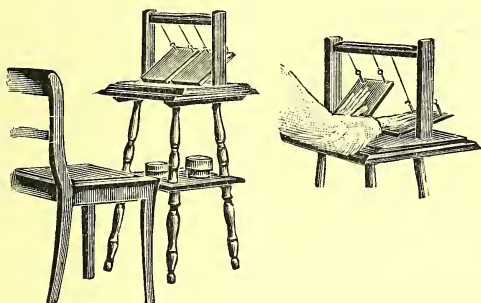


FIG. 4.—Wrist Flexion and Extension Self-resisted Movement.

after placing the extremity in equilibrium, in a fixed position, the resistance to be overcome be equal to, or less than the weight of the extremity concerned.

The lightening of labour by the employment of appliances presenting but slight resistance is, therefore, not only subjective, but objective. In this fact lies the explanation of the striking phenomenon that the patient who has been properly instructed in their use, experiences a feeling rather of recuperation than of exhaustion.

The end to be kept in view in using mechanical appliances for cardiac treatment is, in fact, not so much to introduce a certain amount of resistance to be overcome, as it is to furnish the patient with a guide and a support. Hence, when properly used, appliances specially indicated for such treatment, would be more

appropriately named "guiding" than "resistance" apparatus.

On the above grounds I incline, in my choice of apparatus, to reject most of the Zander machines, as well as the new excentric appliances of Herz. These latter, in developing the specific energy of a group of muscles, satisfy primarily the scientific requirement that the work should gradually rise and fall in parallel with the extension curve of the muscle.

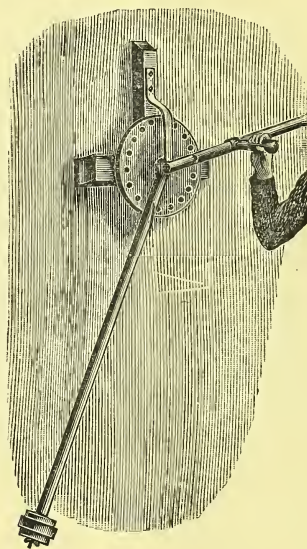


FIG. 5.—Arm Flexion. Duplex Active Movement and Arm Extension.
Duplex Passive Resisted Movement.

For the "guided movements" of the upper extremities I prefer the very simple wooden appliances of Mager.

For gymnastic exercise of the lower extremities, which I have already mentioned as of the greatest importance, as relieving the heart by diverting a considerable proportion of the blood stream to the periphery, I have found, after many trials, nothing which fulfils these requirements so efficiently as the tricycle, as modified by myself. Its construction and the technique of its use, I have fully explained in a previous monograph "On the Use of the

Tricycle as a Means of Carrying out Therapeutic Exercises." As I have there shown in detail, there is no other form of exercise for the lower limbs which admits of such accuracy of dosage and which, in a manner agreeable to the patient, so favourably influences the pulse and respiration. My experiments were conducted in Berlin, at the Moabite Hospital, and were fully reported in the *Zeitschrift für diätetische und physikalische Therapie*, vol. v.

Among other cases referred to there was that of a patient who was the subject of considerable cardiac dilatation, and was incapacitated from walking. In the course of about two months he improved to such an extent that he

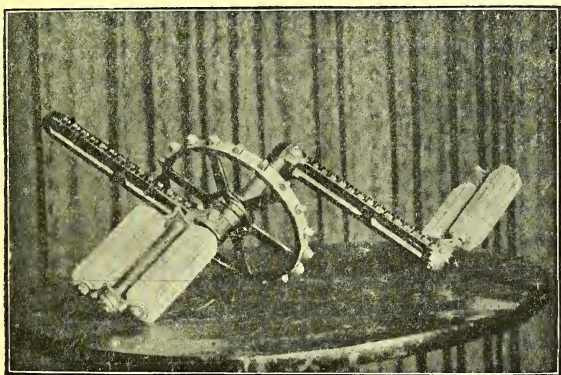


FIG. 6.—Crank of the modified tricycle, with slots from the axle to the free end with centimetre divisions. (a) Furthest point, 18 cm. from axle; (b) nearest point, 2 cm. from axle.

was able to take an hour's regulated exercise on this tricycle, mounting and dismounting it alone, and subsequently to proceed home without assistance.

If important therapeutic results are to be attained, it is, of course, necessary that the precautions which I have described in my pamphlet, should be strictly observed. It is only by obedience to them that a machine originally destined merely for pleasure touring can be made to serve as an appliance of the greatest utility in medical gymnastics. Without here entering into detail, I would emphasize the necessity, in successfully conducting therapeutic cycling exercises, of an even, concrete or asphalt practising

ground, so arranged that it affords shelter from the force of the wind, while freely admitting sun and air.

In an article in the *Berliner Medizinische Wochenschrift*, I have shown that to drive and keep in motion, on an exercising-ground such as is above described, a tricycle constructed to my design, and loaded to 150 lbs., involves an amount of labour which is quite infinitesimal. To express it in numbers, it is equal to about the fiftieth part of that which would be required to raise a like weight through a height of eight inches.

It is much to be regretted that the profession, as a whole, is opposed to cycling exercise. This attitude has been, to a certain extent, attributable to a number of instances of real damage which were in fact the result of misuse and over exertion; while it has been contributed to still more largely by existing theoretical prejudices, as well as by experiments which have been faultily arranged and erroneously interpreted. Thus has arisen the bugbear of a supposed frequently recurrent acute dilatation of the heart, tending to become a permanent condition; whence the careful family physician has come to the conclusion that it is his duty to issue a simple prohibition.

At a recent Medical Congress, Hoffman (thus agreeing with Moritz), showed, in a most lucid exposition of the whole subject, the improbability of the occurrence of an acute, transitory dilatation of the healthy heart, and pointed out the sources of error which had led other authors, among them Schott, Herschell and A. Smith, to adopt this fallacious supposition. In view of this expression of opinion, it is to be hoped that the excessive timidity of the medical world with regard to cycling exercise will now gradually disappear, and that the transition period will witness the development of the latter from an amusement too often senselessly pursued, into a rational form of exercise. Its signal potency as a therapeutic agent I have already dwelt upon, while Zuntz, Fürbringer, and (in England) Turner, have not only directed attention to it, but placed it upon a physiological basis.

Against active and passive resisted movements as afforded by my modified tricycle, none of the objections can be urged which, partly with reason and partly without, have been adduced against cycling as an amusement. As contrasted with other mechanical gymnastics the use of such a tricycle has the advantage that it offers somewhat

more mental stimulus, and that it is carried on in the open air.

This leads me to state that the second cardinal requirement in cardiac gymnastics is that they should, to the utmost possible extent, be performed out of doors. The theoretical considerations in favour of open-air, as opposed to indoor gymnastics need not, I am sure, be dwelt upon before an audience of my own profession ; while, that such open-air exercises are entirely practicable, I have had abundant opportunity of demonstrating in the course of my practice at Nauheim.

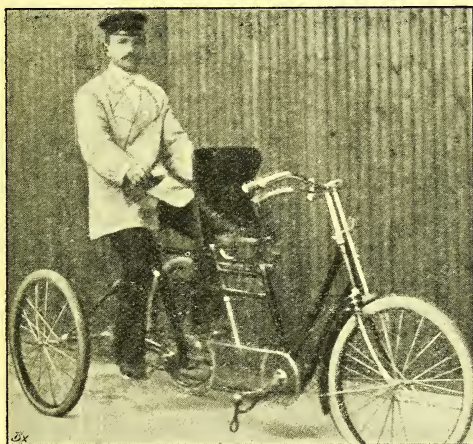


FIG. 7.—Modified Tricycle for passive movement and locomotion. (a) Patient's seat with support for back, slotted cranks, buckles for attachment to seat and pedals.

Herz, however, expresses the hope that no one will be found to maintain that locomotion (a factor which is non-existent in all indoor appliances, including the stationary cycle), plays a part of importance in any treatment planned in accordance with the principles of Oertel.

In reply to this, I would urge that it is precisely this element of progression which brings into play a fresh mental and physical stimulus of the utmost therapeutic value. I will content myself here with merely an allusion to the influence upon the surface of the body of air in

motion, with its results in increased cutaneous excretion and, through the respiratory function, a rise in gaseous exchange. In this way, it appears to me, is explained the singular phenomenon that in cyclists the sense of fatigue is postponed beyond its due time.

The action of properly regulated exercises upon cardiac patients is to lower the rate of the pulse and of respiration. In illustration, I here abstract from my notes on a great number of cases the following, as typical examples :

(1) Mrs. K., aged 36, tachycardia.			
Pulse before tricycle exercises,	...	...	130
" after " " "	...	...	108
Respiration before tricycle exercises,	...		22
" after " "	...		16
(2) Mrs. H., aged 26, mitral incompetence.			
Pulse before tricycle exercises,	...	...	78
" after ten minutes' of tricycle exercise,			72
Respiration before	"	"	16
" after ten minutes' of	"	"	14
After another five minutes, pulse 68, falling to			62
Respiration	"	"	12
(3) Mr. D., aged 28, cardiac neurosis.			
Pulse before tricycle exercises,	...	...	83
" after ten minutes' of tricycle exercise,			80
Respiration before	"	"	20
" after ten minutes' of	"	"	16
After a further ten minutes the pulse fell to			78
And the respiration to	...	...	12

A pulse tracing taken in immediate connexion with these exercises usually shows diminished vascular tension and an increase of cardiac force, while the patient experiences a subjective sensation of well-being. These exercises should never result in increased frequency of the pulse and respiration, as would be the case with healthy persons when performing normal gymnastics. If this be noted, it should be considered as a strict contra-indication to the application of gymnastics in any form.

I find, on the whole, that mechanical treatment proves beneficial in about half the cases which present themselves. In many instances, exercises become useful after a previous short course of balneological treatment. I have never been able to satisfy myself of the occurrence of a notable lessening of dilatation and diminution of the

area of cardiac dulness as an immediate sequence of any form of therapeutic exercises, as has been described by Dr. Schott.

The gratifying result of the gradual approach of a dilated heart to normal conditions seems to me to be, not the momentary outcome of any single therapeutic measure, but to comprise the combined action of all the resources at our disposal—balneological, dietetic and mechanical—methodically applied; while such a result is favoured by complete rest from all harmful outside influences.

I may summarize my conclusions as follows:

(1) For heart disease, mechanically given exercises are equivalent to manual and self-resisted gymnastics; but the use of mechanical appliances is to be preferred, as imposing the lesser strain.

(2) Resistance and speed are to be so reduced that no increase in frequency of the pulse and respiration shall occur.

(3) The exercises should always be given in the open air, and only under medical supervision.

(4) Slow self-propulsion, under due supervision, on a suitably modified tricycle, and over a firm, even and well sheltered surface is, owing to its beneficial influence as a respiratory exercise, taken in conjunction with the added stimulus it affords, of signal assistance in mechanico-balneological cardiac therapy.

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